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### Beneath the Surface / eca

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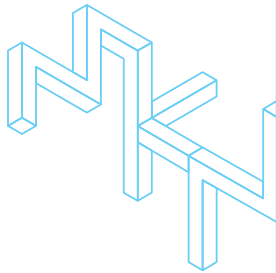
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## Beneath the Surface: Digital-craft borderlands in education

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The course, BA Jewellery and Silversmithing at Edinburgh College of Art, is a four-year under-graduate course with an international reputation as one of the UK's most highly regarded courses to study this craft based subject.

### Limited Edition; Stephen Bottomley

Limited Edition is a third year live project introduced in 2009 by Stephen Bottomley when he started in Edinburgh as Head of Department. For the past five years the project objectives have been to introduce students to the available range of methods of digital design and manufacture. In this time, the students have become more digitally literate and open to the idea that digital design and manufacture can enhance their hand making studio practice without replacing it.

This live, industry placed project involves the students working collaboratively, both internally with other design students at ECA, and externally with the excellent computer aided design (CAD) team at Weston Beamor in Birmingham, which is one of Europe's leading casting and Rapid Prototyping (RP) jewellery specialists.

The project brief is to create a limited edition batch production run of at least ten pieces of work that utilises CAD and manufacture working with Weston Beamor's casting, and their sister company, Domino, for RP facilities.

A study visit to the factory is important both to meet the manufacturers and understand the process from an industrial and commercial perspective, which underlie the LIVE nature of the project (Image 1). It is written into the agreement with Weston Beamor that the students will receive two rapid prototyped CAD models back for evaluation. It is important they receive their first model and have time to evaluate it and make changes to either the digital file or the actual model before moulding the pieces for reproduction and final

### Abstract

*This paper explores the current craft practices and ethos of academic craft makers within the Design School at Edinburgh College of Art / The University of Edinburgh.*

*Edinburgh College of Art (ECA) has had a strong virtuous tradition of studio-based practice dating back to the 18th Century and now, with an increasing community of digitally versed makers, practices go beneath a material surface to investigate shared themes of production, narrative and memory.*

*How are digital methodologies being introduced to traditional studio based craft programs like Glass, Jewellery and Silversmithing by subject practitioners (Bottomley and Gray) and applied by their new emerging makers?*

*Have values of craftsmanship altered when operating in the territory between craft culture and digital making?*

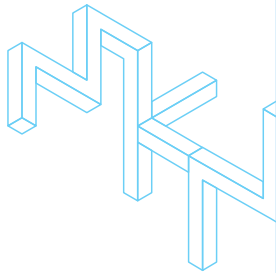
*To explore these questions the philosophical approaches to research and practice of Bottomley and Gray to research and practice, will be examined in relation to the academic curricula they shape through projects and post-graduate research at ECA. This paper will demonstrate how the digital alone cannot deliver polished and beautiful finished products and recognise the importance of integrating essential hand skills and tacit material knowledge with the use of modern digital technologies.*

**Keywords:** Integration, (im)-materiality, practice-led teaching.



Image 1

Image1.  
Jewellery and  
Silversmithing  
students tour of  
Weston Beamor,  
2011.



casting in metal. Only a short, limited, but focussed period of bench work is available at the end of the semester before the work is due for exhibition and for sale. This puts pressure on the students to think cleverly about their design and ensure there is little arduous post-production finishing.

Students, over the course of the first 15-week semester in year three, are exposed to a complete design cycle; from the research and design, to prototypes and final pieces (Image 2). The design development is achieved through a combination of hand drawing and 3D modelling that is run in parallel with small refresher master classes in CAD, run by Kathryn Hinton.

Importantly, the digital design drawings are often done whilst working from analogue, hand-made models in wood, plastic or metal. This is a low-tech / high-tech approach to integrating digital skills with the traditional studio based craft skills taught on the Jewellery and Silversmithing program. It lays equal importance on each process feeding the other and supports the existence of a 'close relationship between digital work and craft practice' (McCullough, 1998).

Time management is an important feature of the project with students at the start of the project not only knowing the deadline and the date of the show, but also the first date the original CAD file must be with the RP company Domino, for the first prototype (Image 3). The date to have the final design confirmed for moulding and casting in metal is also scheduled so they can anticipate when they are likely to have the castings back at the studio in time for assembly (Image 4).

Importantly, students learn to cost and value their time while working to these deadlines and appreciate that they may need to collaborate as a designer with industry to achieve commercial work with a broader market rather than as they would with making one-off, bespoke, gallery jewellery. Working to tight parameters or constraints is an important design challenge to master.

Balancing the drive for a commercial exhibition / sale with the project's aim to encourage students to explore the digital process for making forms that might otherwise be too time consuming or difficult to hand make, is an accepted part of the project that always leads to interesting discussions at critiques and reviews. A balance is often successfully found and the project is one where the majority of students cover all their costs and even make a profit.

Interdisciplinary collaborations have developed exciting partnerships between Product Design students who formed teams to develop design concepts and, more recently, Graphic Design students who ran a parallel packaging project with the jewellery students as their clients (Image 5).

Reflecting on the work of the past five years and the sixty or so students who have been through this project, and questioning if the values of craftsmanship have altered through operating in the territory between craft culture and digital making, it is clear that

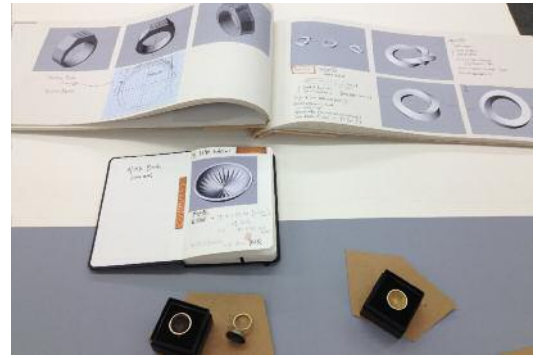


Image 2

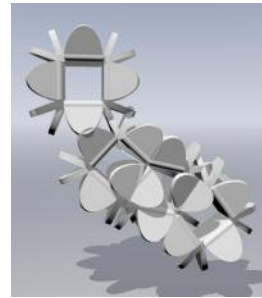


Image 3



Image 4

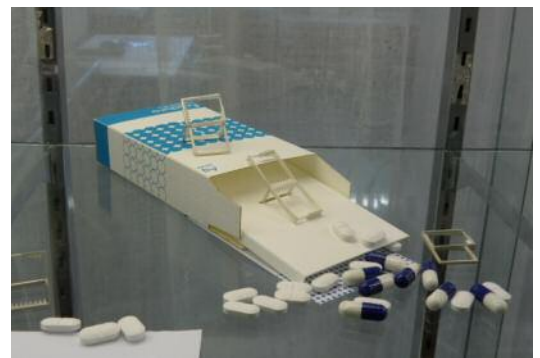


Image 5

digital technologies have added a great deal to the existing toolkit of skills a designer/maker has available. Shillito presents digital technologies as tools to be mastered, the same as any other tool in a makers 'toolkit' but qualifies this by saying:

*However, as being 'digital' means the processing part is 'hidden', making understanding and controlling the process from concept to end product seem more complicated, unfamiliar... and definitely not craft. (Shillito, 2013, p.9)*

The values of making objects well and achieving high standards of design and making are still as important today as in the past. Work, like the jewellery of MA graduate Alice Bo-Wen Chang, reflects her previous training as an architect and confidence with the computer software she used to design windows and cladding for skyscrapers (Image 6). The scale has changed, and in this piece of 2011, Chang cleverly used the small prototyped and silver castings as kinetic puzzle pieces that could slide around on the larger hand cut frame they occupied.

1. Dongsun Lee, 2013.

Image 2.

Jewellery and Silversmithing student Hannah Leigh design process, 2012.

Image 3 & 4.

Linda Johnston, digital model; Finished silver casting and wax prototype, 2010.

Image 5.

Eva Melinka finished display, 2013.

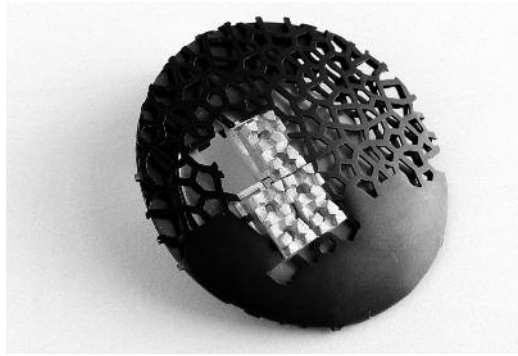
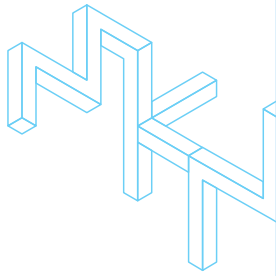


Image 6

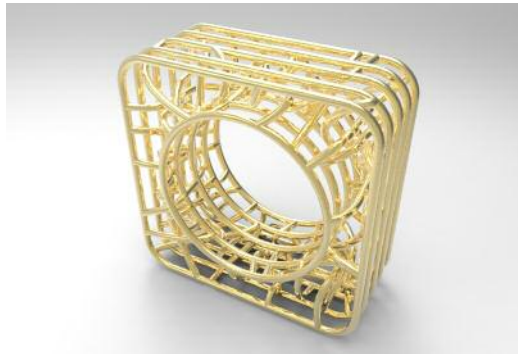


Image 7

Recent developments have seen students literally *breaking the mould* of the casting size limitations imposed by Weston Beamor and are now exploring sintering technologies with companies like Shapeways who work with with Cooksons Gold. Who have installed three gold sintering machines at their Birmingham factory in 2013. This year the students also designed jewellery to be sintered on these machines (Image 7). For the first time they ran a national competition and one of our student's designs was made and exhibited by the company at national trade fairs.<sup>1</sup>

#### Analogue AND Digital; Jennifer Gray

With reference to my own research into ways of using traditional hand skills alongside modern 3D digital technologies, I will discuss my reasons for advocating that students have the opportunity to learn these combined methods in all relevant disciplines.

Digital technologies available to a maker today present new opportunities never before possible in the pre-digital past. Objects are now being created which would just not have been feasible before the introduction of 3D printing and digital model making software. Digital technologies alone cannot deliver polished and beautiful finished products. In some instances new digital technologies are hailed as the complete answer or solution, but they are really just a means by which one can start to explore new possibilities and are certainly not inherently creative in themselves. We should think of the digital as part of a *toolkit* to be used alongside other skills. It is important for institutional departments to ensure that essential hand-skills and tacit material knowledge will never be lost, but rather complimented through the use of

modern digital technologies.

Glenn Adamson, when speaking about the integrated use of digital methods is quoted as saying:

*The ones to watch are those who see clearly that its value is only contingent – that it requires a considerable amount of buttressing to have a significant effect. While the digital does depend, ultimately, on the analogue, the contrary is true as well. (Adamson, 2013, p.171)*

At ECA we aim to integrate new digital tools gradually after the student has developed a basic grounding in the key materials and techniques of their departmental discipline. They will eventually be skilled enough in both to confidently move between analogue and digital and not rely solely on one or the other, thus allowing them to develop their own material/technical identity.

I began professional life as a jeweller/silversmith in 2006. Carving and lost wax casting were amongst my core skills. During this time, if a job required me to repeat a product in a different scale or with a slight variation of form, I would have had to re-carve a completely new piece, costing further time as well as the client's money (Image 8).

I became interested in digital technologies because it offered the possibility to scale and easily repeat models, enhancing design possibilities and in turn expanding my market. In the past I was often quite put off by the prospect of having to learn modeling packages such as Rhino – which was the main 3D modeling program available to learn at this time. I just couldn't see how learning this engineering style package might relate to, or enhance my studio work or the making experience that I had spent so many years developing.

I eventually found what I was looking for in a 3D modeling package called Z Brush which allowed me to continue 'carving' in the virtual realm. It was to become my main stepping stone towards embracing digital technologies and a point from which I could understand the benefits of familiarising myself with further software packages.

The tools in this program are specifically devised to duplicate my real tool kit. I could still use my pre-existing skills and using digital technologies didn't mean having to retrain completely. I could just adapt.

To carve wax I rely on my eyes to examine my



Image 8

#### Image 6.

Alice Bo-Wen  
Chang Kinetic  
brooch, 2011

#### Image 7.

Dongsun Lee,  
finished gold  
sintered piece,  
2013.

#### Image 8.

Jennifer Gray, hand  
carving of a head  
from wax. Making  
process image from  
wax to silver  
casting.



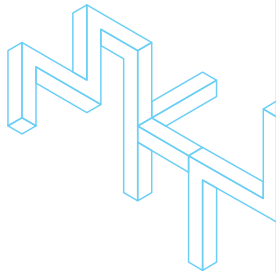


Image 9



Image 10



Image 11

**Image 9.**

Digital models,  
Screenshot 2012.

**Image 10.**

3D printed models,  
Objet resin, 2012.

**Image 11.**

3D printed model  
clusters, Objet  
resin, 2012.

**Image 12.**

Wax Garland  
moulded from 3D  
prints, 2012.

**Image 13.**

Amphora Necklace,  
Jesmonite,  
Ceramic, Leather,  
2013.  
Photo: © M. Booth

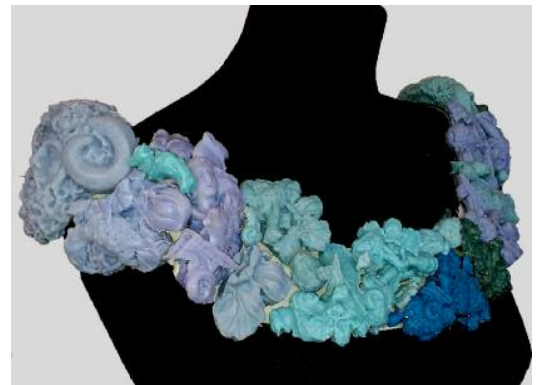


Image 12



Image 13

workspaces (Image 12).

Personally, I feel that 3D printing materials, at this point in time, couldn't replace the general aesthetics and qualities of the wood, metal, plastic and stone I currently use in my final works. They still require hand finishing or re-working into another material. At this time 3D printing materials are still a step behind the digital modelling packages and tools. I use the 3D printed models purely as part of my design and making processes.

Using further hand-made and digital processes, my final models are produced in various materials to suit their ultimate purpose (Image 13). I also use this technology to 3D print parts of my work which I can then out-source to practitioners of other disciplines. For example, I hire a ceramicist to slip cast large hollow vessels for me.

I model the 3D object to the exact required scale in programs such as Rhino, print it, mould from it and then hand it over to the ceramicist to slip cast in porcelain. Before this technology was available the ceramicist would have had to make moulds from my design drawings, and there would be no guarantee that they would turn out exactly as I wanted them. Today I am, in essence, making the item in a virtual realm so the artisan can realize it in his or her own material to the millimetre. I can then be reassured that my work will have both the quality and aesthetic consistency that I require.

This work would not be possible without my experience of both traditional and current digital methods. I aspire to produce work that can leave the viewer uncertain as to how it was made. I hope to

subject and my hands to remove material with steel hand tools. The same methods are utilised when carving virtually. As far as possible, I use manual settings when carving my models in Zbrush so they appear similar to my hand carved forms (Images 9-11).

A virtual block of wax appears on my computer screen and I carve it as you would by hand. Using this method, I substitute my steel wax carving tools with a USB drawing tablet. The final models are 3D printed in Objet resin or Zcorp, manipulated further, then cast in other materials.

Encouraged by my successes with digital carving and 3D printing, I polished up on Rhino and learned to use other 3D packages. I realised more could be gained through working with a full range of software packages, just the same as I would use a full range of tools and machinery to make my work in the workshop. I developed a way of using digital technology that felt quite natural for me and my way of working.

Sometimes I carve then I scan, manipulate digitally, then combine with hand-fabricated elements. In other instances I will carve, 3D print, then re-carve by hand. I tool then retool the objects both in virtual and real

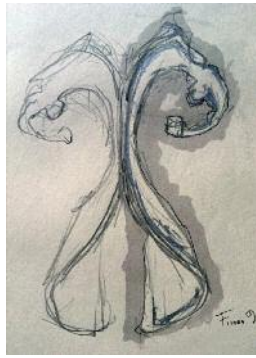
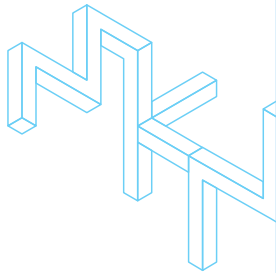


Image 14



Image 15



Image 16

demonstrate that technological approaches and traditional methods can blend quite naturally together in a piece of work.

In some of the work produced by our current degree and postgraduate students it has been encouraging to see that each has used digital processes which compliment their studio work rather than define it (Images 26–34).

In the recent Design Commission report into embedding growth through design, innovation and technology in education they say that:

*In order for 'digital making' to be embedded properly within the curriculum, it must be fused with 'physical making' skills. We must end the simplistic assumptions that it is easy to design something on a computer using CAD, or that young people are no longer interested in building with their hands and using basic tools. (The Design Commission, 2014, p.46)*

With this in mind, it is our aim to produce dynamic, mindful makers and problem solvers with hand skills that enable them to continue honing and making where 3D technology ends. People, and excellence in the work they produce, should be the sole centre of our attention and not simply the digital processes used in its making.

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**Stephen Bottomley** trained at the Royal College of Art (MPhil RCA 1999–2001) and the University of Brighton (MA 1996–98) – which included an exchange to Rhode Island School of Design (USA 1998). Academically he has directed degree programmes at Hastings College of Art, Sheffield Hallam University and currently leads the MA, MFA and BA Jewellery and Silversmithing programmes at Edinburgh College of Art / The University of Edinburgh. As a maker his business was established in 1990 and his work is internationally exhibited and held in several major collections including the National Museums of Scotland and the British Museum, London.

**Jennifer Gray** is an award winning designer/maker and tutor in the Jewellery and Silversmithing Department at Edinburgh College of Art. She is a graduate of The Glasgow School of Art and the Royal College of Art and is based between Edinburgh and London. She produces objects and jewellery in a range of materials using techniques, which move in and out of the hand-made, and the digital. Each series is unified, in particular through use of traditional hand carving methods, enhanced by taking advantage of emerging digital technologies.  
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